INDUSTRIAL STANDARDIZATION

A MONTHLY REVIEW

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Quality of Metal Surfaces[1]

by

John Gaillard, *Mechanical Engineer*
American Standards Association

Graphical records of surface unevenness provide an accurate method of analyzing the finish produced by various tools

Quality of surface of metal parts—that is, generally speaking, the size, shape, and distribution of minute unevennesses—has a direct influence on the fitting together of these parts and consequently on their functioning and rate of wear. Parts required for running fits are now often finished to a high quality of surface, by grinding followed by lapping or honing, for example, instead of being given a lower quality of finish, the improvement of which is left to running-in of the parts when assembled. In the latter case, the abrasive action of metal particles loosened from parts during the running-in period exert a damaging influence on the surface, which is avoided when parts having the proper finish are assembled.

Surface quality concerns not only machined parts, however, but also parts and semi-finished materials made by such processes as casting, cold drawing, and rolling. A certain quality of surface may also be required solely from the point of view of appearance.

The problem has arisen of how to express surface quality in terms of measurement, so that different qualities may be compared and also indicated on drawings and in specifications by symbols, numbers, or names that have a definite standard meaning instead of by the different terms now used by individual firms. A technical committee on this subject was recently organized[2] under the procedure of the American Standards Association, with the American Society of Mechanical Engineers and the Society of Automotive Engineers acting as joint sponsors for the project.

No complete solution of this problem has as yet become known, but an interesting study in this field was published as a thesis for the degree of doctor of engineering by a German engineer, Willy Kiesewetter, as the result of investigations made at the Engineering Academy of Dresden. Some of Dr. Kiesewetter's findings and a summary of different methods used in the study of the problem are given below.

One method of judging a surface consists in making a cast of gelatine or some other plastic material. This cast is cut in thin slices, each of which when viewed under a microscope shows an outline of the surface. This method can be used for unevennesses down to about 0.0001 in. Because of the warping of the cast and the slices, however, the method is not reliable from the viewpoint of accurate measurement. At best it gives a general impression of the nature of the surface.

An improvement of the method just described was successfully applied by Dr. C. B. Sawyer of Cleveland, Ohio, and described in the appendix to R. E. W. Harrison's paper on the subject.[3] It consists in copper plating the surface investigated, the parts in question being then cut in two and the cross-section inspected under the microscope. The copper plating keeps the unevennesses of the original surface in shape during the cross-sectioning process.

Several optical methods for investigating surface quality have been proposed. A simple one consists in letting the surface reflect a certain object, for example a piece of a newspaper, the degree of clearness and accuracy with which the printed type is reflected being taken as a basis for judging the surface quality. A surface can also be investigated by means of the light interference effects produced by an optical flat.

Another optical method is based on the fact that, for any surface whose unevennesses lie within definite limits, there is a certain angle at which the reflection of figures changes from diffused to regular. This method does not work for unevennesses smaller

[1] Reprinted from *American Machinist*, November 23, 1932.

[2] Announcement of the organization meeting of the new Sectional Committee on Classification and Designation of Surfaces According to Quality of Surface (B46), which will have charge of the development of standards on surface qualities under the procedure of the American Standards Association, was published on p. 23, January, 1933.

[3] See ASA BULLETIN (now INDUSTRIAL STANDARDIZATION), November, 1931, p. 12.

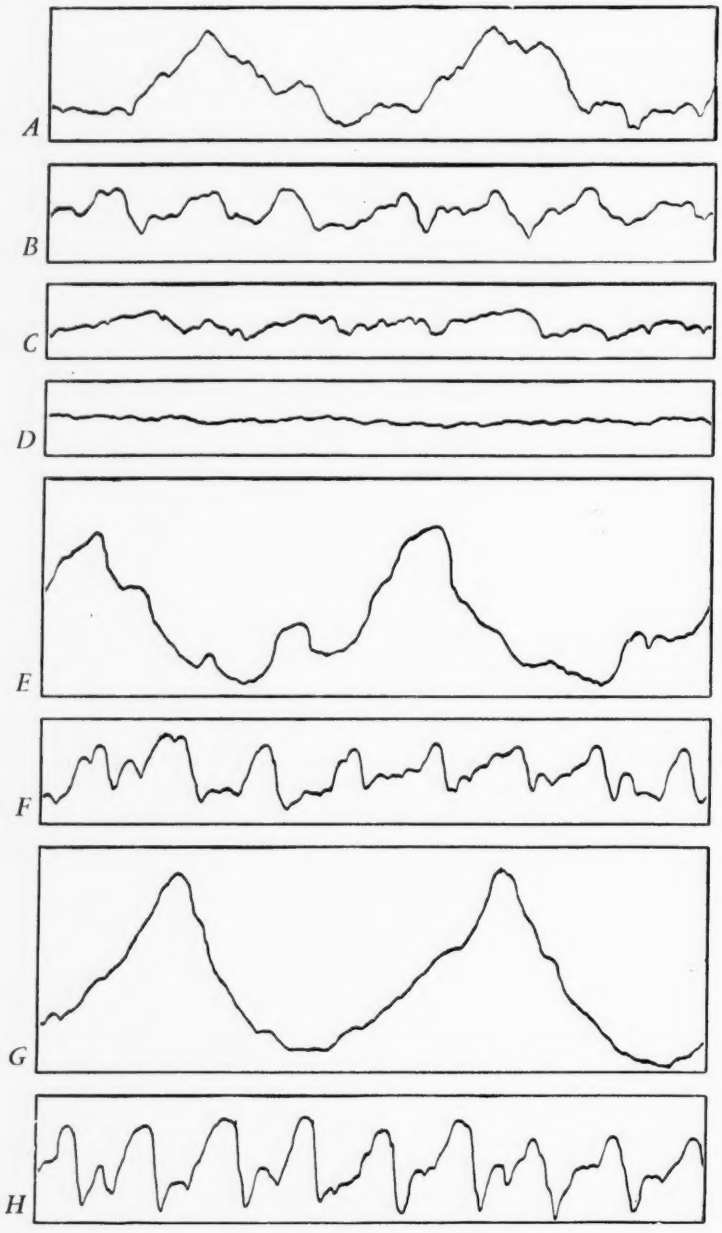


FIGURE 1
Machined finishes on steel

A—rough planed, $h = 11.3$; *B*—smooth planed, $h = 2.8$; *C*—milled (straight tooth cutter), $h = 1.85$; *D*—milled (spiral tooth cutter), $h = 0.55$; *E*—rough turned, $h = 18.5$; *F*—smooth turned, $h = 3.55$; *G*—rough faced, $h = 24.5$; *H*—smooth faced, $h = 5.63$. *Vertical scale*—*A*, 217; *B*, *C*, *D*, *F*, and *H*, 455; *E* and *G*, 152 to 1.

than about 0.00004 in., nor for those larger than 0.00024 in. In the former case, the surface gives regular reflection at any angle and in the latter case, at no angle.

Some optical instruments are based on the principle of determining the ratio between the amount of light reflected by the surface in the diffuse and in the regular manner, respectively. In the final analysis, all of these photometric methods give a basis of comparison for the glossiness of the surface, but no definite basis of measurement for its quality.

A method of translating the number of unevennesses per inch of length of the surface concerned into frequency of sound vibration—or in other words into tone of a certain pitch—was developed by R. E. W. Harrison in a paper presented at the annual meeting of the American Society of Mechanical Engineers, December, 1930, entitled "A Survey of Surface Quality Standards and Tolerance Costs Based on 1929-1930 Precision Grinding Practice."[4] A needle is moved over the surface investigated and the impulses caused by the unevennesses are electrically transmitted to a loudspeaker. They may also be transmitted to a millivoltmeter, causing the latter to deflect. Oscillograms obtained by this method give a permanent record of the nature of the surface.

Direct investigations of surfaces have also been made by means of a needle. Its point travels over the unevennesses, and the resulting displacements are either projected to an enlarged scale on a screen, or recorded on a moving strip of photographic paper by a beam of light reflected by a small mirror connected with the needle. The needle may also be provided at some distance from its point with a diamond recording point which finely scratches the record of the needle's ups and downs into a piece of glass attached to the test piece. This record may be examined under the microscope or enlarged.

The investigations made by Dr. Kiesewetter were carried out by means of gramaphone needles. The diameter of their point, found to average about 0.0025 in., determines the depth to

[4] Published in the ASA BULLETIN (now INDUSTRIAL STANDARDIZATION), November, 1931, p. 4.

which the point will go down into the valleys of the minute unevennesses. When it does not reach the bottom, the profile curve recorded will become shallower than it should. This difficulty was overcome in an ingenious manner. A cast of copper amalgam of the surface investigated was made and a profile curve

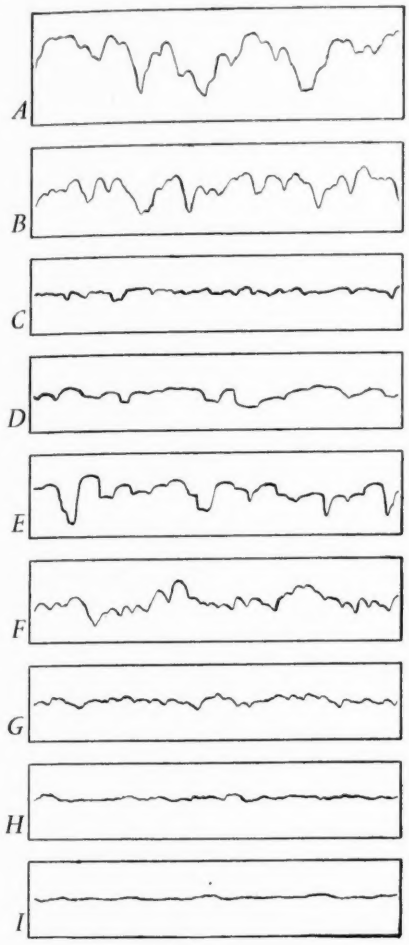


FIGURE 2
Machined finishes on steel

A to *C*—*finished with machine-cut files*. *A*—rough file, $h = 4.45$; *B*—coarse file, $h = 2.75$; *C*—dead smooth file, $h = 0.59$; *D*—finished with milled bastard file, curved teeth, $h = 1.5$; *E*—finished with milled smooth file, straight teeth, $h = 2.4$. *F* to *I*—*finished with emery cloth*. *F*—coarse grain, $h = 1.85$; *G*—medium grain, $h = 1.14$; *H*—fine grain, $h = 0.52$; *I*—polished, $h = 0.28$. *Vertical scale*—455 to 1, for all curves.

of this cast was recorded with the same needle. The valleys of the original surface become the peaks of the cast, and these can be recorded without error. A combination of the two curves thus obtained gives the true profile of the original surface.

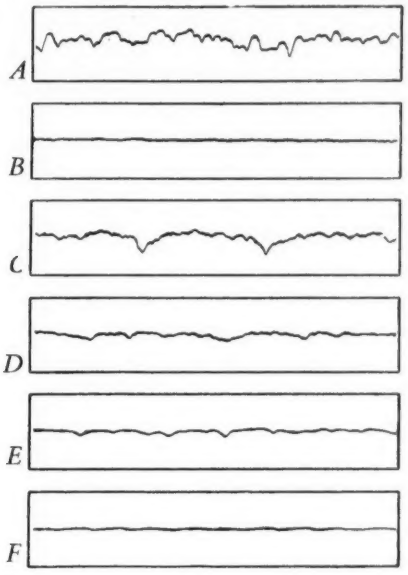


FIGURE 3
Machined finishes on steel

A and *B*—*cylindrical grinding*. *A*—coarse grain, $h = 1.26$; *B*—fine grain. *C* and *D*—*surface grinding*. *C*—coarse grain, $h = 0.79$; *D*—fine grain, $h = 0.63$. *E*—*scraped*, $h = 0.87$. *F*—*lapped*. *Vertical scale*—455 to 1, for all curves.

With a view to wear, each needle was used for recording only 20 surface curves. The needle was kept in contact with the surface by a pressure of about five grams. The speed of the recording paper was 100 times the speed with which the test piece was moved past the needle. The reliability of the method was proved by the fact that two curves of the same surface, consecutively recorded, were found to be completely identical.

A number of curves recorded by Dr. Kiesewetter are shown in Figures 1 to 7. The kind of metal of which the part was made and the method by which the surface was finished are indicated in each case. In the horizontal direction, the scale of all surface curves is 50 to 1, or in other words, one inch of the diagram represents a length of 0.02 in. measured on the actual surface. The vertical scale of the curves is indicated for each diagram, together with the value h representing the average depth (arithmetic mean) of the valleys of the entire curve determined by means of a planimeter. Only in cases where the curve differs too little from a straight line the value h is not given.

Dr. Kiesewetter observes that no conclusions should be drawn from the appearance of the surface curves as to possible improvements of the respective methods of surface finishing, the number of cases investigated being too small for giving a reliable basis in this respect. He also says that the purpose of his study was not to arrive at conclusions of this kind but to demonstrate the suitability of the needle method for recording the nature of the surface.

The several machine finishes were applied to test samples made of steel with a tensile strength of 45 kg per sq mm or about 64,000 lb per sq in.

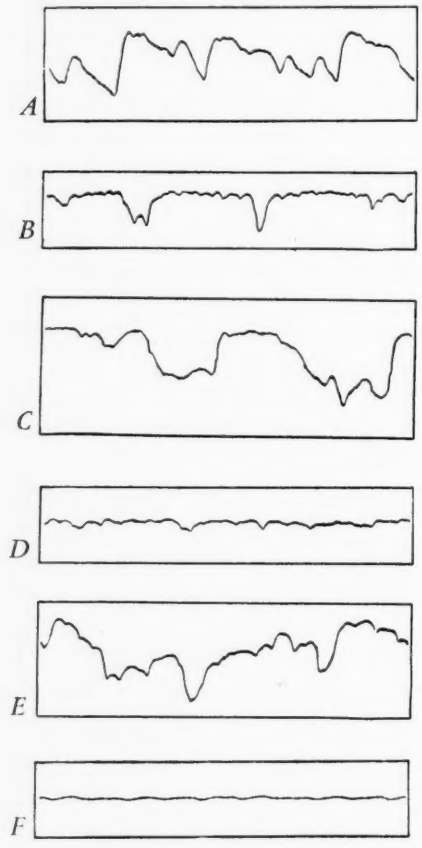


FIGURE 4
Machined finishes on steel

A—broached, $h = 4.14$; *B*—drilled (5 mm), $h = 2.68$; *C*—drilled (20 mm), $h = 9.9$; *D*—reamed, sharp reamer, $h = 0.63$; *E*—reamed, dull reamer, $h = 3.83$; *F*—press finished, $h = 0.32$. *Vertical scale—A, B, D, E,* and *F*—455, and *C*—217 to 1.

In order to prevent the results of the tests from being influenced by scratches not originating from the surface-finishing process under investigation, all test samples were ground first.

The investigation made by Dr. Kiesewetter is much more comprehensive, both in regard to number of cases studied and to the digesting of the results, than the limited scope of the present article permits to indicate. Some of Dr. Kiesewetter's comments on the several cases reproduced in the illustrations are given in the following section.

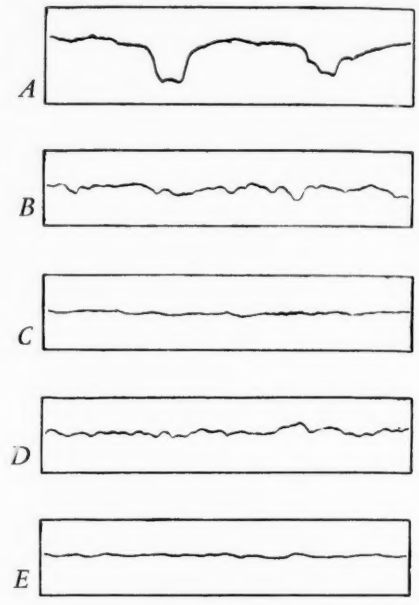


FIGURE 5
Surface qualities

A—sawed steel, $h = 5.3$; *B*—drawn brass, $h = 0.28$; *C*—rolled brass, $h = 0.32$; *D*—drawn iron, $h = 1.02$; *E*—diecasting, $h = 0.67$. *Vertical scale—A,* 152; *B, C, D,* and *E,* 455 to 1.

Comments by Dr. Kiesewetter

Turning, facing, planing, and milling (Figure 1)—The distance between the valleys or the peaks of a turned or planed surface is determined by the feed. The peaks often show two indentations, while the valleys and the flanks of the hills are always distinctly roughened because of metal chips being torn off or jammed. In the case of the milled surfaces, it is interesting to note the considerably smoother finish obtained, under otherwise identical conditions, with a spiral tooth cutter as compared with a straight tooth cutter.

Filing and polishing (Figure 2)—Diagrams *A, B,* and *C* (Figure 2) represent surfaces finished with machine-cut files. The effect of the difference in coarseness of the files is clearly visible. The curves of diagrams *D* and *E* (Figure 2) were obtained from surfaces finished with milled files.

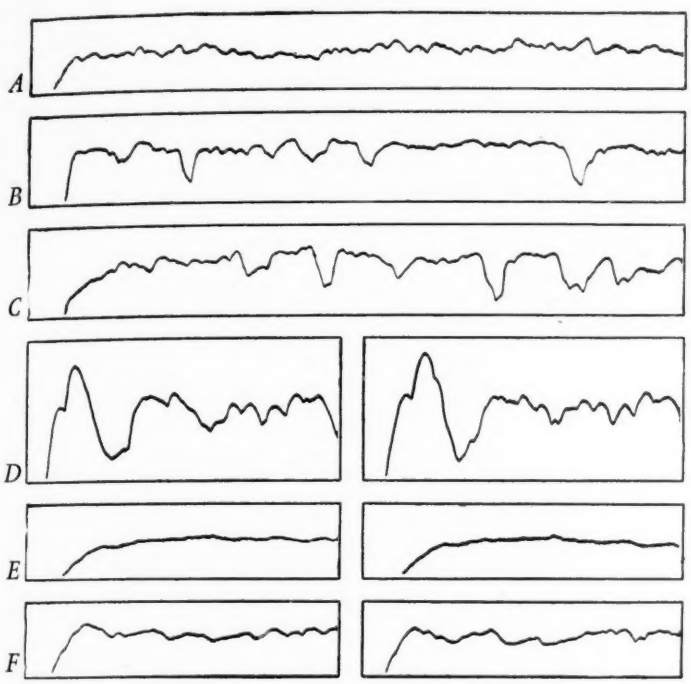


FIGURE 6

Surface quality of screw threads

A, B, and *C—threads cut on 1-in. steel nuts. A*—with single-point tool, $h = 0.79$; *B*—with cut tap, $h = 1.3$; *C*—with ground tap, $h = 2.64$. *D, E,* and *F—threads produced on ⅜-in. iron bolts. D*—with diehead, $h = 2.88$; *E*—rolled, $h = 0.35$; *F*—rolled, later tests, $h = 0.67$. *Vertical scale*—455 to 1, for all curves.

Because of the larger size of the teeth of machine-cut files, the material finished with the latter is more strongly torn. As a result, a machine-cut "second-cut" or "smooth" file may produce a surface with unevennesses greater than those of surfaces finished with a milled bastard file. The curves in

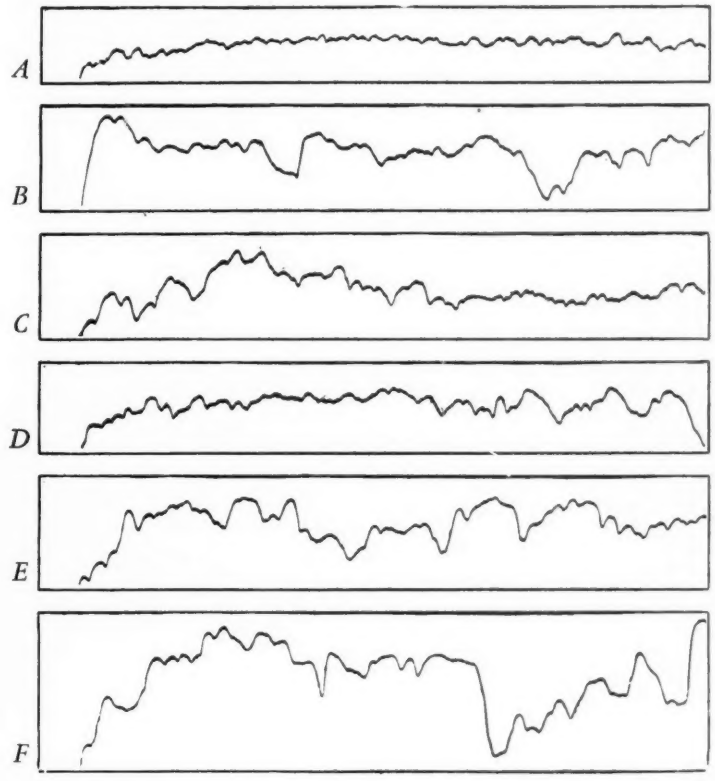


FIGURE 7

Surface quality of screw threads cut on 1-in. bolts

A to *D—thread cut on steel stock. A*—with single-point tool, $h = 0.95$; *B*—with roughing and finishing dies, $h = 2.88$; *C*—with special dies, $h = 1.85$; *D*—with ground die-chasers, $h = 1.42$. *E*—cut with radial diehead on bright iron screw stock, $h = 2.76$. *F*—cut with radial diehead on black iron screw stock, $h = 3.55$. *Vertical scale*—455 to 1, for all curves.

diagrams *F* to *J* (Figure 2) show the results of polishing with abrasive cloths of different grain sizes.

Cylindrical and surface grinding, scraping, and lapping (*Figure 3*)—Curves *C* and *D* (Figure 3) clearly show the influence of grain size of the grinding wheel and of the feed of the grinding machine. Fine grain and slow feed result in smaller unevennesses. In diagrams *A* and *B* (Figure 3) representing portions of ground cylindrical surfaces, the influence of the grain size is pronounced. The cylindrical grinder has given a smooth surface, while the unevennesses obtained by surface grinding were larger, but Dr. Kiesewetter observes that this result should not be generalized without further investigation.

Broaching, drilling, reaming, and pressfinish (*Figure 4*)—Particularly interesting here is the difference in finish obtained with a new sharp reamer and with a worn dull reamer, diameter 21 mm (about 0.83 in.) as shown in diagrams *D* and *E* (Figure 4) respectively.

Sawing, drawing, rolling, and diecasting (*Figure 5*)—Drawn brass stock, diagram *B* (Figure 5) appeared to have much smaller unevennesses than drawn steel stock, diagram *D*. The surface quality of rolled brass sheets, diagram *C*, closely approaches that of drawn brass bar stock. Diecast parts, diagram *E*, appeared to have a smooth surface.

Threading (*Figures 6 and 7*)—Diagrams *A, B,* and *C* (Figure 6) show the curves for the surface quality of internal threads, diameter one inch, cut on steel parts with different threading tools. There is a distinct difference between the thread *A* cut on the lathe with a single-point tool and the threads *B* and *C* cut with taps. Dr. Kiesewetter reports that the ground taps usually produced threads with rougher flank surfaces than did cut taps, a point that seems to call for further investigation. Six curves representing the surface quality of thread flanks of 1-in. steel and iron bolts (Figure 7) also show that the best surface quality was obtained with a single-point tool.

Diagrams *D*, *E*, and *F* (Figure 6) show the results of tests on ⅜-in. bolts made of iron screw stock. These tests were made to determine the respective surface qualities of cut and rolled threads. The data of diagrams *E* and *F* on rolled threads were obtained by recording curves for two different spots on each of the bolts in order to eliminate the chance of hitting an exceptionally good or bad spot. The rolled threads appeared to be much cleaner than the threads cut with a diehead. Also, the threads cut on bright iron stock appeared to be better than those cut on black stock; see diagrams *E* and *F* (Fig. 7).

A.S.T.M. Publishes 1932 Proceedings

The American Society for Testing Materials has published the 1932 *Proceedings* of the Society. As has been customary in recent years, this publication is issued in two parts. Part I (1071 pages) contains the annual reports of the Society's many committees and also reports of sectional committees for which the Society is sponsor. In Part II (824 pages) appear technical papers presenting results of research investigations sponsored by the Society.

In Part I, the annual reports of the various committees, together with current recommendations regarding standards, cover ferrous and non-ferrous metals, and various non-metallic materials. Part I also includes appendices containing reports on much special work under the direction of the various committees, and 85 tentative standards issued or revised in 1932.

In Part II is published one group of papers on steel castings that was presented at a symposium in this special field. This symposium, which has also been published separately, is reviewed below. Results of an extensive research investigation on the embrittlement of hot galvanized structural steel cover 82 pages of this section. Other ferrous and non-ferrous subjects are also treated in several papers. In the field of non-metallic materials, several papers on various aspects of textiles, cements, pigments, and new developments in testing machines are included.

Each part of the *Proceedings* may be purchased from the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, or from the American Standards Association, at the following prices: paper binding $5.50; cloth $6.00; half leather $7.00.

Symposium on Steel Castings

The American Society for Testing Materials has published a volume containing the papers presented at the Symposium on Steel Castings sponsored jointly by the American Foundrymen's Association and the A.S.T.M. This symposium was held in conjunction with the annual meeting of the Society in June, 1932. Ten extensive technical papers, together with the discussion, are included in this volume.

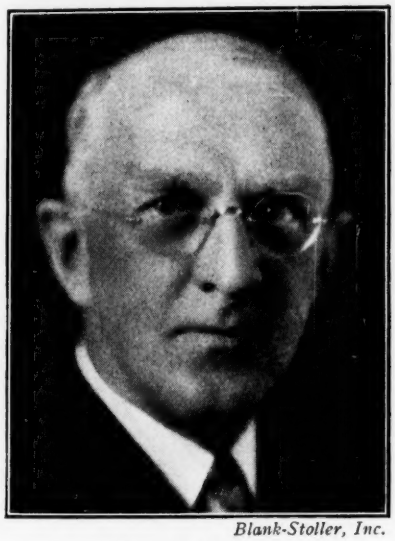
These papers cover the statistical position of steel castings in the United States, together with much pertinent information regarding the physical and chemical properties of cast steel, and include recent developments in American practice. This symposium, although published in Part I of the *Proceed-*

ings may be purchased separately for $1.00 from the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, from the American Foundrymen's Association, 220 West Adams Street, Chicago, or from the American Standards Association.

Barnum and Nicholson New Board Members

Two new members have just been elected to membership on the Board of Directors of the American Standards Association. Dana D. Barnum, president, Boston Consolidated Gas Company, has been elected on nomination of the American Gas Association, which is represented on the Board for the first time, and Samuel L. Nicholson, acting vice president, Westinghouse Electric and Manufacturing Company, has been elected to succeed Clarence L. Collens as representative of the National Electrical Manufacturers Association.

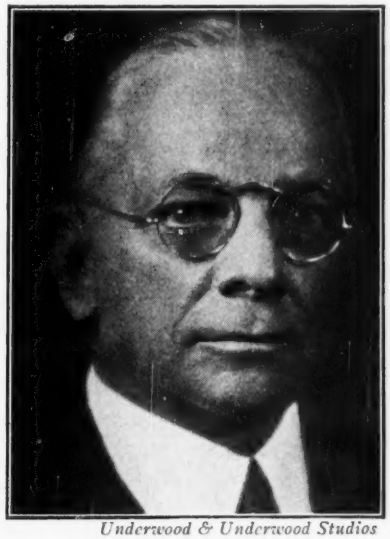
Mr. Barnum was graduated from Stevens Institute with the degree of Mechanical Engineer in 1895. He began his business career in the employ of E. W. Bliss & Company of Brooklyn, New York, immediately following his graduation, and after a short period with this company, went to the Worcester Gas Light Company as draughtsman and chemist. After becoming superintendent of that company, he held various positions until he was elected president in 1915. In 1917 Mr. Barnum was called to the Boston Consolidated Gas Company, and was elected president in 1921. He is also a Director of this company. Mr. Barnum is a past-president of the American Gas Association.



Blank-Stoller, Inc.

Dana D. Barnum

Mr. Nicholson began his career in the Novelty Electric Works of Philadelphia in 1887. Before his connection with the Westinghouse Electric and Manufacturing Company in 1898, he held important positions with the Chadborne-Hazelton Company of Philadelphia, the Wenstrom Dynamo & Motor Company, the Electrical Railway Construction Company, the Short Electric Company, the Technique Electrical Works, James Boyd and Brother, the Cutter Electric and Manufacturing Company, and the C. & C. Electric Company. Mr. Nicholson has been acting vice-president of Westinghouse since 1925.



Underwood & Underwood Studios

Samuel L. Nicholson

Mr. Nicholson took a leading part in the development of standardization activities in the electrical industry, and has represented the National Electrical Manufacturers Association on the ASA Standards Council since 1925.

In 1925 he was presented with the James H. McGraw Award for contribution to progress in the orderly regulation of the installation and inspection of electrical materials and equipment.

Members whose terms expired and who were reelected to the ASA Board of Directors are Lyman J. Briggs, Acting Director, National Bureau of Standards, Washington, D. C., representing the U. S. Department of Commerce; Howard Coonley, president, Walworth Company, New York, representing the American Society of Mechanical Engineers; and Clayton R. Burt, president and general manager of the Pratt and Whitney Company, Hartford, representing the National Machine Tool Builders Association.

Privileges and Discounts Extended to ASA Members

In order to increase the value of membership in the American Standards Association, new policies will go into effect immediately allowing discounts to Members on all standards purchased; and to those whose membership is $100 a year or more free copies of *new* American Standards will be available following publication.

Discount of 20 per cent on standards purchased.—All Company Members will be given a discount of 20 per cent from the single copy price of all approved American Standards, both those that have been issued in the past and those that appear currently. This should make it easier for companies to provide copies of standards to all those in their organizations who are in any way concerned. In some instances, pre-publication quantity purchase discounts will be offered and notices regarding these will go to all Members in ample time to place orders at the special rates. This plan is not entirely new, but is an outgrowth of recent experience with the standards approved in 1931 for the four major species of wood poles. Pre-publication discounts were offered to both producers and users with the result that many of the producers used the standards as sales promotion material, having special covers bound on, or inserting the standards with other printed matter of their own. Where there is possibility of wide use, such an arrangement means that ASA passes on to purchasers the lower costs of quantity production.

Free copies of standards to $100 Members.—One free copy of each newly approved standard in which a Company Member is interested will be supplied upon request for each $100 of annual membership. Thus, a Member whose dues are $300 a year will be entitled to three free copies of each new American Standard. Notices will be received by Members from time to time so that they will know when new publications are available.

A Company Member whose dues are $500 a year or more shall be entitled to receive free copies of standards previously approved, as well as the new ones. The exact number will depend upon the amount of annual dues. All Members in this classification will receive individual communications outlining this service in detail. This new service will be of particular interest to organizations maintaining company libraries.

Free subscriptions to monthly review.—The new policy increases (in most cases) the number of subscriptions to INDUSTRIAL STANDARDIZATION which Company Members can receive without charge. A definite schedule has been set up according to the rate of membership beginning with three subscriptions for Company Members at the minimum rate of $25 a year, and one additional copy for each additional $25 of dues. For example, if a company maintains a membership at $200 annually, free subscriptions to the monthly review can be sent to ten persons in the organizations without extra charge. Extra subscriptions beyond what the membership rate includes are available at the regular price of $4.00 a year. Under this new schedule, Company Members will find it easier to keep their engineers and executives informed about the current progress in industrial standardization activity so that immediate advantage can be taken of the latest developments.

ASA information service.—All Members are urged to use the ASA information service through which copies of more than 10,000 different American and foreign standards and specifications are available and may be borrowed at any time. There have been many instances where the ready availability of this material has been worth many times the annual membership dues of companies utilizing the service. For example, one manufacturing concern was able to fill an important foreign order on time, only because there were available in the ASA files certain foreign specifications referred to in the order. This information can be of great value to companies manufacturing for export, or those wishing to purchase goods or materials from abroad. A Member may borrow either specific standards or all standards on a stated subject.

To companies whose membership rate is $100 a year or more, a special service is available which includes the use of the ASA's numerous American and foreign contacts and sources of information for material not otherwise easily available.

Individual Members.—Individual Members paying $10 a year will receive one free subscription to INDUSTRIAL STANDARDIZATION, and will also be given a discount of 20 per cent on the purchase of *one* copy of any approved American Standard. They may also borrow foreign standards and loan mate-

rial mentioned in INDUSTRIAL STANDARDIZATION. More extensive research and information service, however, is of necessity available only to Company Members.

Hydro-Electric Power Commission to Label Canadian Appliances

The following announcement is made by the Underwriters' Laboratories:

Following the adoption of the Canadian Electrical Code in 1927 and subsequent arrangements for the development of what is called Part II of that Code in the form of standards applying to different classes of electrical devices and materials, the majority of Canadian electrical manufacturers, whose products have heretofore been listed or labeled by Underwriters' Laboratories, have expressed a preference to employ the services of the Hydro-Electric Power Commission of Ontario for these products rather than those of Underwriters' Laboratories.

On January 1, 1933, therefore, Underwriters' Laboratories' listing, label, and reexamination services on electrical devices and materials manufactured in the Dominion of Canada are to be discontinued. All, or nearly all, of these Canadian electrical products will be listed by the Hydro-Electric Power Commission of Ontario, which will extend to them its listing and label service as already applied to other Canadian electrical products.

Lightning rods and motors, controllers and fittings for use in hazardous locations, however, will continue to be tested and listed by Underwriters' Laboratories.

Underwriters' Laboratories will continue its present listings and label and reexamination services on products other than electrical as made in Canada by Canadian manufacturers. These include fire doors and windows, extinguishers, tanks, roof-covering materials, refrigerators, hose, oil burners, and other non-electrical items.

The Hydro-Electric Power Commission will continue as heretofore and under the same arrangements with United States' manufacturers to list a large number of electrical products manufactured in the United States on the basis of their being listed and labeled by Underwriters' Laboratories. It is expected that Underwriters' Laboratories will cooperate with the Hydro-Electric Power Commission and with the Canadian Engineering Standards Committee at Ottawa for the maintenance, so far as possible, of equivalent electrical standards.

Foreign Standards Available from ASA

New foreign standards available to Sustaining-Members for loan or purchase through the ASA office are listed below. They are available in the language of the country under which they are listed. In requesting copies of the standards it is necessary to list only the ASA serial numbers preceding the titles. Send either a post-card or a note containing only the name of the person wishing to receive the standards, and the numbers of the standards desired. The card or envelope should be addressed to the American Standards Association, 29 West 39th Street, New York.

Serial Number

Germany

327. Bronze castings, quality and performance
328. Commercial seamless brass pipe
329. Construction and operation of sewerage systems for small tracts, principles of legal and technical administrative rules
330. Technical specifications for the construction and operation of sanitary systems
331. Covers and rubber rings for preserving glasses
332. Lockers for clothing for workshop and office use, outside dimensions
333. Record strips for recording meters
334. Steel and iron construction materials, classification, designation
335. Thick bushings
336. Transportation conveyor chains
337. Undersizes for three-fluted drills and four-fluted shell drills
338. Wheel flanges for standard gage vehicles, finished profiles, railroad equipment

Australia

339. Fibrous plaster sheets
340. Marking and coloring of patterns (foundry)
341. Overhead line wire material for telegraph and telephone purposes
342. Water supply and sanitary fittings

Index to INDUSTRIAL STANDARDIZATION

The index to the 12 issues for the year 1932 comprising Volume 3 of INDUSTRIAL STANDARDIZATION is published as Part 2 of this issue. Copies of indexes to the 1930 and 1931 issues will be furnished upon request. Company-Members wishing to complete their files of INDUSTRIAL STANDARDIZATION may write the ASA office for missing numbers.

ASA PROJECTS

A Review of Mechanical Engineering Projects Under ASA Procedure

The fourth of a series of reviews of standardization projects under the procedure of the American Standards Association

The status of all mechanical engineering projects under ASA procedure, with the exception of the safety code projects, is summarized in the following review. The report of the safety code projects was published in the issue of November, 1932. The data presented in this review are taken from the files of the American Standards Association and are corrected to January 1, 1933, bringing up to date the review of mechanical projects published in the issue of February, 1932.

B1—Screw Threads

Sponsors—American Society of Mechanical Engineers; Society of Automotive Engineers.

The revision of the American Standard for Screw Threads for Bolts, Machine Screws, Nuts, and Commercially Tapped Holes (B1a-1924) has been practically completed, but some of the proposals have still to be published for general criticism and comment. The principal recommendations made by the sectional committee in its meeting of January 11, 1933, are as follows:

The coarse threads series will be supplemented by the 1-⅜ in. size, with six threads per inch, and the 3-¼, 3-½, 3-¾, and 4 in. sizes, all with four threads per inch. No change has been made in the values of the four classes of tolerances given in the 1924 standard, but Class 1 tolerances will be deleted for all fine threads, and Class 4 tolerances will be deleted for the machine-screw sizes. A proposal to reduce the maximum minor diameter of nuts in sizes smaller than ¼ in. will be embodied in the revised draft to be published for general criticism and comment.

Series of 8-pitch and 12-pitch threads will be added for diameters from 1 to 6 in. inclusive, screws and nuts of both series to have either Class 2 or Class 3 tolerances, the former being recommended for general use. (The 1-⅜, 1-⅝, and 1-⅞ sizes, with eight threads per inch are those whose addition was desired mainly by the pipe line interests.)

A series of 16-pitch threads will be added for diameters from ¾ to 4 in. inclusive. They are intended primarily for use on adjusting collars and lock nuts for anti-friction bearings. Screws and nuts will have Class 3 tolerances only.

A tentative draft on acme threads was approved for circulation to the sectional committee. It deals with general-purpose threads in sizes from ¼ to 5 in.; stub threads, basic depth of thread 0.3 pitch, angle 29 degrees; and 60-degree stub threads, basic depth of threads 0.433 pitch. It is intended to publish these threads as a separate standard.

The Screw Thread Survey has been completed and a report will be circulated to the sectional committee before being printed.

The Subcommittee on Wood Screws will be enlarged, and the work on threads for lag screws will be discontinued.

B2—Pipe Thread

Sponsors—American Gas Association; American Society of Mechanical Engineers.

The proposed rearrangement of the data on taper pipe threads contained in the American Standard for Pipe Thread (B2-1919) was completed by the subcommittee concerned, which also unanimously approved the proposed addition of an alternative design of gage. Release of these proposals for review by the entire sectional committee and by industry at large is being withheld until agreement on the question of thread lengths of American Standard taper threads and of the corresponding A.P.I. taper pipe threads (A.P.I. Standard 5 L-1931) has been reached by the subcommittee.

B3—Ball and Roller Bearings

Sponsors—American Society of Mechanical Engineers; Society of Automotive Engineers.

Some revisions of, and additions to, the American Standard B3a-1930 have been approved by ASA. The revised standard is designated as B3.1-1933. (The existing American Recommended Practice B3b-1930, published in one pamphlet with B3a-1930, is not affected by these revisions.)

The proposed American Standard series of taper roller bearings, which has already been adopted as an SAE standard, has not yet been submitted to ASA. As an international proposal, it was considered by the technical committee of the International Standards Committee at its meeting held in the spring of 1932 in Milan, which was attended by E. Wooler, member of the sectional committee, as the American delegate. It did not seem to find favor with the Continental countries, however.

A revised proposal on adapter-sleeve bearings and an extension of the series of angular-contact-type bearings are under consideration.

B4—Allowances and Tolerances for Cylindrical Parts and Limit Gages

Sponsor—American Society of Mechanical Engineers.

The Working Committee, the appointment of which was decided upon by the sectional committee at its December, 1931, meeting, has been organized, but no proposals have as yet been developed. A tentative report on the latest developments in the Technical Committee on Fits of the International Standards Association (ISA), which has worked out a system of fits recommended for adoption as a national standard in the countries affiliated with the ISA, was sent by the ASA office to the sectional committee in January, 1933, so that it may decide whether the ISA proposal is suitable for adoption by American industry.

B5—Small Tools and Machine Tool Elements

Sponsors—American Society of Mechanical Engineers; National Machine Tool Builders Association; Society of Automotive Engineers.

Technical Committee 1-T-Slots.—After the publication of the American Tentative Standard on T-Slots, their Bolts, Nuts, Tongues, and Cutters (B5a-1927), a suggestion was received from industry that the height of the tongue be increased, the depth of engagement between the tongue and the table slots as given in the standard being too small to insure proper alignment of fixtures with the table slot. An increase in height, requiring no change in tooling nor in the slot itself, was tentatively adopted by the technical committee in its December, 1932, meeting.

Technical Committee 2-Tool Holder Shanks and Tool Post Openings.—No revision of the American Standard B5b-1929 on this subject is being considered at the present time.

Technical Committee 3-Machine Tapers.—A proposed series of machine tapers comprising Brown and Sharpe tapers 1, 2, and 3; Morse tapers 1 to 5 inclusive, supplemented by a new 4½ size; and ten 0.750-in.-to-the-ft tapers, has been under consideration as a compromise "slow" taper series for some years. In the spring of 1932, the technical committee considered the question whether this proposal should not be abandoned in favor of a series of steep tapers with hold-back device. Tapers of this kind, which have already been applied to milling machines, are covered by patent rights. Tests with these tapers have been made and the patent situation has been investigated for the information of the technical committee, and both activities are being continued. The majority of the technical committee appeared to be of the opinion that the "slow" taper series could not yet be eliminated, whatever the technical advantages of the steep tapers might be and that consequently it might be necessary to include both series in the proposed American Standard. The technical committee intends to take further action on the slow taper series in its April, 1933, meeting.

Technical Committee 4-Spindle Noses and Collets for Machine Tools.—The proposed American Standard for Lathe Spindle Noses, distributed in 1931 for general criticism and comment, was adopted by the turret lathe group, the single spindle automatic lathe group, and the multiple spindle automatic lathe group, of the National Machine Tool Builders Association, as a standard for these groups, the date on which they will put it into effect to be decided later. This action is significant in regard to the further progress of this proposal since the N.M.T.B.A. is one of the joint sponsors for project B5. A subgroup of the technical committee is giving consideration to the development of a standard for engine lathes.

Technical Committee 5-Milling Cutters.—The American Standard for Milling Cutters, Nomenclature, Diameters, Thickness, and Other Important Dimensions (B5c-1930) was approved by ASA in 1930. So far, no comments have been received that appear to call for a revision of the standard at the present time.

Technical Committee 6-Designations and Working Ranges for Machine Tools.—No progress on this subject can be reported.

Technical Committee 7-Twist Drill Sizes.—The canvass of industry on proposals "A", "B", and "C", on sizes and lengths of twist drills distributed in February, 1930, showed a majority to be in favor of proposal "C". However, the former Drill and Reamer Society (now a division of the Metal Cutting Tool Institute) objected to the proposal. At the December, 1932, meeting of the sectional committee where the situation was discussed at length, it ap-

peared that the Institute wished to have an opportunity to reconsider the matter. For this reason action on a formal recommendation by the sectional committee that proposal "C" be adopted as the American Standard series was postponed till the meeting to be held in the spring of 1933.

Technical Committee 8-Drill Jig Bushings.—A proposed American Tentative Standard on Jig Bushings, covering dimensions and tolerances for press fit, renewable and liner bushings, was published for general criticism and comment in November, 1932.

Technical Committee 9-Punch and Die Holders.—A proposed American Tentative Standard on Punch and Die Sets covering five types of sets and details of holding clamps was published for general criticism and comment in June, 1932. Comments received were considered at the December, 1932, meeting of the technical committee.

Technical Committee 10-Circular Forming Tools and Holders.—The replies to the proposal sent out in 1931 were considered and agreement reached on designations, machine groupings, widths, diameters and mounting holes of circular tools, dovetail angles and dimensions of adjusting slots for dovetail tools, and method of adjusting. The recommendations on machine groupings and proposed diameters of circular tools and lengths of dovetail tools were submitted to the automatic screw machine builders for their comments, which were considered in revising the recommendations.

A revised proposal was sent out in November, 1932, to the members of the technical committee and manufacturers of screw machines.

At the December, 1932, meeting of the Sectional committee it was decided to extend the original scope of the technical committee to cover, also, forming tools other than circular.

Technical Committee 11-Chucks and Chuck Jaws.—An American Standard on Rotating Air Cylinders and Adapters (B5.5-1932) was approved by ASA in September, 1932. A subgroup of the committee has completed a proposal which gives dimensions of a series of proposed heavy-duty chucks, sizes 15 to 36 inches inclusive, to fit the March, 1931, draft of the proposed American Standard for Lathe Spindle Noses. The committee has postponed further development of the smaller size chucks, and the complete line of lighter duty chucks, until Technical Committee 4 on Lathe Spindle Noses and Collets for Machine Tools has completed its work.

Technical Committee 12-Cut and Ground Thread Taps.—Since the American Standard on Taps, Cut and Ground Threads (B5e-1930) was published, the question has come up whether it would be desirable to reduce the overall length and the thread length of hand taps. A questionnaire was sent out and about 400 replies were received which are now being analyzed.

The technical committee has also developed a proposal for standard dimensions of pulley taps, tapper taps (machine screw size), bent shank tapper taps (cut and ground thread), and taper and straight pipe taps. These are to constitute a supplement to the American Standard B5e-1930.

Technical Committee 13-Splines and Splined Shafts.—Recent improvements in machines and tooling have reduced the cost of making splines whose sides are involute curves to the point where these have become competitive with straight-side splines, the type generally in use when the committee was organized. The committee considered the possibility that the involute spline might displace the straight-side spline within the period of time required for setting up a standard for the latter type, which then would be obsolete when completed. Under these conditions the committee decided to mark time pending further developments in this field.

Technical Committee 14-Electric Welding Dies and Electrode Holders.—General business conditions have prevented the completion of the tests made in actual practice with two types of electrode bodies and tips—one with a taper fit and one with an inside thread attachment. However, completion is expected at an early enough date to draft final recommendations at a meeting in the spring of 1933.

Technical Committee 15-Milling Machine Tables.—A tentative proposal for the spacing of the slots in the tables of knee-type milling machines, classified in five ranges of width, is expected to be submitted at an early date to the entire sectional committee.

Technical Committee 16-Rotating Tool Shanks.—This committee held its first meeting in April, 1932, at which three subgroups were appointed to develop the sections on (1) drill, reamers and tap shanks, diameters and squares; (2) bit brace shanks; and (3) shanks on socket wrenches with driven nuts and screw-driver shanks for rotating drivers. Subgroup 1 on Drill, Reamer, and Tap Shanks, presented a tentative report to the technical committee.

Technical Committee 17-Nomenclature.—Three meetings were held by this committee, which appointed two subgroups, on Milling Cutters and on Lathe and Planer Tools, respectively. The former adopted the nomenclature for milling cutters as given in the American Standard B5c-1930, and the latter developed a list of terms and definitions. At the December, 1932, meeting of the sectional committee, the task of the technical committee was defined as comprising the review and unification of nomenclature pertaining to the work of the techni-

cal committees dealing with tools or machine tool elements, and the standardization of nomenclature in cases where this question would come up in regard to subjects for which no technical committee has as yet been appointed (such as lathe and planer tools).

Technical Committee 18-Drill Head Spindles and Bearings.—Eleven representative manufacturers of drill heads and drill presses were asked to contribute data regarding the main dimensions of their drill heads and the lower ends of their drill spindles. Seven of the companies replied and six furnished information useful to the committee. The committee expects to receive the further information required for developing a tentative proposal on standard overall dimensions for drill heads and standard connections to spindles during the present year. It appears that, for the time being, the drill-head manufacturers consider it somewhat impracticable to establish standard overall dimensions, and some of them emphasize that drill presses will have to be more completely standardized before much can be done toward standardizing multiple drill heads. There is, however, a more favorable sentiment with regard to standardizing the spindle connections of these drill heads and toward standardization of drill holders.

B6—Standardization of Gears

Sponsors—American Gear Manufacturers Association; American Society of Mechanical Engineers.

An American Standard for Spur Gear Tooth Form (B6.1-1932) was approved by ASA. This is a combination of the data on the 14½-degree composite system and the 20-degree stub involute system approved in 1927 as American Tentative Standard B6b-1927 (now promoted to the status of American Standard) and new data referring to the 14½- and 20-degree full-depth involute systems.

A proposed American Recommended Practice on Gear Materials and Blanks of Alloy Steel, Cast Steel, Forged and Rolled Carbon Steel, also Bronze and Brass, developed by a subcommittee, was recently approved by the sectional committee.

The Recommended Practice of the American Gear Manufacturers Association on Inspection of Gears was submitted to the subcommittee on this subject to serve as a basis for its work.

B16—Pipe Flanges and Fittings

Sponsors—American Society of Mechanical Engineers; Heating and Piping Contractors National Association; Manufacturers Standardization Society of the Valve and Fittings Industry.

A revision of the American Tentative Standard for Steel Pipe Flanges and Flanged Fittings (B16e-1927) was approved by ASA as the American Standard on Steel Flanged Fittings and Companion Flanges (B16e-1932). The changes and additions were summarized in an article "Revised Standard on Steel Fittings and Flanges" in the January, 1933, issue of INDUSTRIAL STANDARDIZATION, page 30.

A proposed standard for screwed pipe plugs was approved by the sectional committee.

Three projects have made good progress, but are not yet ready for final approval; namely, a proposed standard for welding flanges; the proposed center-to-face dimensions for ferrous flanged valves, which were published for general criticism and comment in 1931; and the revision of the port openings of the 125-lb cast-iron flanged fittings in sizes from 14 to 24 in.

B17—Standardization of Shafting

Sponsor—American Society of Mechanical Engineers.

The revision of four American Standards previously developed by this committee—Diameters and Lengths of Cold-Finished Shafting (B17a-1924); Standard Widths and Heights of Square and Flat Stock Keys (B17b-1925); Square and Flat Plain Taper Stock Keys (B17d-1927); and Square and Flat Gib Head Taper Stock Keys (B17e-1927)—is nearing completion. A questionnaire sent out to industry has settled the last controversial points, and an early submission to the American Standards Association of the revision (to be published in a single pamphlet) is expected.

B18—Bolt, Nut, and Rivet Proportions

Sponsors—American Society of Mechanical Engineers; Society of Automotive Engineers.

A revision of the American Tentative Standard on Dimensions of Wrench-Head Bolts and Nuts and Wrench Openings (B18b-1927) was submitted to ASA in January and its approval as an American Standard is now under consideration. Its most important feature is the inclusion of a series of heavy bolt heads and nuts, so far commonly designated as "U. S. Standard".

The draft standard for large rivets was revised on account of objections received from the rivet manufacturers in regard to certain head designs and tolerances, and will be published again for general criticism and comment.

A draft standard for socket-type set and cap screws, developed by a subcommittee, will be published for general criticism and comment at an early date.

B26-1925—Screw Threads for Fire-Hose Couplings

Sponsors—American Society of Mechanical Engineers; American Water Works Association; National Board of Fire Underwriters.

No change has occurred in the status of this project.

B27—Plain and Lock Washers

Sponsors—American Society of Mechanical Engineers; Society of Automotive Engineers.

The proposed American Tentative Standard on Lock Washers, published for general criticism and comment in December, 1931, is being revised to include the three series of the SAE standard. No progress can be reported on plain washers.

B29—Transmission Chains and Sprockets

Sponsors—American Gear Manufacturers Association; American Society of Mechanical Engineers; Society of Automotive Engineers.

An American Standard for Roller Chains, Sprockets, and Cutters (B29a-1930) was approved in 1930. The problem of standardizing silent chains has appeared to be subject to much greater difficulties. No progress in this line can be reported.

B31—Code for Pressure Piping

Sponsor—American Society of Mechanical Engineers.

The sections on Power Piping, on Fabrication Details (including hangers, welded joints, and joints other than welded), on District Heating Piping, and on Oil Piping have been reviewed by the Editing Committee. It is expected that the section on Gas and Air Piping will be completed very shortly. The latter has been developed in close cooperation with the group in the American Gas Association specially interested in the transportation of natural gas.

B32—Wire and Sheet Metal Gages

Sponsors—American Society of Mechanical Engineers; Society of Automotive Engineers.

No progress can be reported for this project.

B33—Hose-Coupling Screw Threads (Nominal Sizes ½ to 2 In., Inclusive)

Sponsor—American Society of Mechanical Engineers.

The proposed American Standard for Hose-Coupling Screw Threads (for all connections having nominal inside diameters of ½, ⅝, ¾, 1, 1-¼, 1-½, and 2 inches) was brought into final shape and recently submitted to the members of the sectional committee in printed proof form.

B36—Standardization of Dimensions and Material of Wrought-Iron and Wrought-Steel Pipe and Tubing

Sponsors—American Society of Mechanical Engineers; American Society for Testing Materials.

The proposed American Tentative Standard for Wrought-Iron and Steel Pipe for Service at a Maximum Temperature of 450 F was discussed by the sectional committee, and it is expected that it will soon be published for general criticism and comment.

B38—Standards and Specifications for Refrigerators

Sponsors—American Society of Refrigerating Engineers; Bureau of Home Economics; U. S. Department of Agriculture.

This is one of the few projects under the procedure and auspices of the American Standards Association characterized by a principal interest on the part of ultimate consumers. A Code for Testing Domestic Refrigerators Using Ice (B38c1-1931) has been completed and published, and a subcommittee is now endeavoring to produce a test code for similar application to mechanically operated refrigerators. The chairman recently circulated among the members of the technical committee a statement of the situation calling attention to the meager accomplishments of the committee and to the indications of a stalemate, which he attributed to a lack of coordination of manufacturers' and consumers' interests. There are evidences, he said, of reluctance on the part of manufacturers to cooperate in developing means for supplying factual data regarding the performance of domestic refrigerators in terms capable of being understood by the ultimate consumer. The chairman called for a consideration of a future program, three possibilities being named, as follows:

1. Inaction, in which case interest in the matter will die out. This is patently undesirable.
2. Further efforts to bring about cooperative action. This would involve changes in the statement of scope and purpose, or a willing acceptance on the part of all concerned of the program which the committee is now following.
3. Formal dissolution of the committee and abandonment of the project.

Further action on the part of this committee will depend in large measure upon the reactions recorded by the individual members of the technical committee following consideration of the chairman's communication.

B40—Pressure and Vacuum Gages

Sponsor—American Society of Mechanical Engineers.

The work of subcommittee 2, on Definitions, Specifications, and Rules for Installation and Use, is practically completed and its report is expected to be submitted to the sectional committee at an early date.

Subcommittee 3, on Gage Sizes and Mounting Dimensions, completed a questionnaire expected to be sent out to the manufacturers in January, 1933.

Subcommittee 4, on Accuracy and Test Methods, has reached tentative agreement on test requirements for the degree of accuracy and the methods of expressing the degree of accuracy, as well as on the classes of gages to be recommended.

B41—Stock Sizes, Shapes, and Lengths for Iron and Steel Bars

Sponsor—American Society of Mechanical Engineers.

Subcommittee 2, on Cold Finished Steels, is cooperating closely with the Cold Finished Steel Bar Institute in the preparation of a proposed American Standard on this subject, but no definite proposals have as yet been developed.

B42—Leather Belting

Sponsor—American Society of Mechanical Engineers.

Subcommittee 1, on Specifications, has developed a draft standard which is now being revised prior to publication for general criticism and comment.

Subcommittee 2, on Recommendations for Selection, Care, and Installation, has collected data for its work and expects to submit a proposal to the sectional committee at an early date.

B43—Dimensions of Machine Pins

Sponsors—American Society of Mechanical Engineers; Society of Automotive Engineers.

Since the proposed American Standard on Machine Pins (dated August, 1930) was published for general criticism and comment, no further progress has been reported.

B44—Industrial Thermometers

No progress can be reported in this case.

B45—Foundry Equipment

Sponsors—American Foundrymen's Association; American Society of Mechanical Engineers.

No meetings were held, but progress is reported to have been made by correspondence by subcommittee 1 dealing with pattern plates, molding machine parts affecting interchangeability of patterns, flask pins and holes, and general dimensions of stock flasks for jobbing work.

An American Recommended Practice for Foundry Patterns of Wood (B45.1-1932) giving standard color markings for patterns was approved by ASA. This was submitted by the American Foundrymen's Association which had an important part in its development, and which was appointed joint sponsor with the American Society of Mechanical Engineers for the new standard.

B46—Classification and Designation of Surfaces According to Quality of Surface

Sponsors—American Society of Mechanical Engineers; Society of Automotive Engineers.

The sectional committee was organized and held its first meeting in December, 1932. The following scope of the work was unanimously adopted: Classification and designation of surfaces according to quality of surface.

Five subcommittees were appointed to deal with: (1) Standardization of surfaces produced by tools and abrasives; (2) Standardization of surfaces produced by mold, die, rolls, or any other means of deforming materials; (3) Standardization of coated surfaces; (4) Symbols for indicating surface quality on drawings; (5) Ways, means, and apparatus for measuring quality of surface.

B47—Plain and Thread Plug and Ring Gage Blanks

The Specifications for Plain and Thread Plug and Ring Gage Blanks, developed by the American Gage Design Committee, were approved by ASA as American Standard B47-1932. The Gage Design Committee is now working on proposals for additional recommendations.

B48—Inch-Millimeter Conversion for Industrial Use

In October, 1932, a general conference called by ASA unanimously recommended that the value 25.4 be adopted as the American Standard inch-millimeter conversion ratio for industrial use. A request to this effect had been made by the Ford Motor

Company. A proposed American Standard, giving, in addition to the ratio 25.4, conversion tables based on the latter, and rules for rounding numerical values, was accordingly sent out to industry for acceptance. A large number of acceptances have already been received and no objection has been raised to the proposal. It is therefore expected that it will soon be possible for ASA to give the draft its approval.

The general conference also recommended unanimously, first, that more extensive conversion tables than those given in the proposed American Standard as now sent out be developed; and second, that the rules for rounding numerical values be made the subject of a separate standard, as their application is not limited to the inch-millimeter conversion practice but is of wider importance in engineering work.

B49—Shaft Couplings, Integrally Forged Flange Type for Hydro-Electric Units

Sponsor—American Society of Mechanical Engineers.

An American Standard for Shaft Couplings, Integrally Forged Flange Type for Hydro-Electric Units (B49-1932) was approved by ASA. This standard was developed by a committee of the A.S.M.E. and submitted by this Society to ASA.

Safety Code for Work in Compressed Air Initiated

The ASA Standards Council has voted to initiate the development of a Safety Code for Work in Compressed Air, following a request received from the International Association of Industrial Accident Boards and Commissions, to whom sponsorship was assigned.

The scope of the new project is as follows:

> Construction and operating rules for work in caissons, tunnels, or wherever workers are subjected to air under pressure higher than atmospheric; including protection from mechanical hazards, the use of necessary instruments and apparatus, provision of locks, methods of lighting, communication and decompression, the keeping of records, medical attendance, periodic inspection and air analysis, rest rooms, hours of labor, sanitation, ventilation, fire prevention, fire protection, temperature control, and other conditions of work.

Several state regulatory bodies have adopted standards on this subject and a fair degree of uniformity exists. The IAIABC felt that the development of a national code would help in maintaining this uniformity and would minimize the danger of other bodies developing standards differing markedly from those now existing.

Contractors engaged in this kind of work operate on a national basis and, as the equipment used is expensive, they should be relieved of all expense possible due to lack of uniformity in state requirements. The development of such a group of specifications as is contemplated in this project should do much toward accident prevention in what is undoubtedly a very hazardous operation.

ASA Approves Standard for Paper Insulation

Specifications for Impregnated Paper Insulation for Lead-Covered Power Cable (C8.10-1932) have been approved as American Standard by ASA.

These specifications were prepared by the Sectional Committee on Insulated Wires and Cables (C8), which is now under the sponsorship of the Electrical Standards Committee.

The requirements of the specifications are identical with those for insulation in the *Specifications for Impregnated Paper-Insulated Lead-Covered Cable* (fourth edition, December, 1931) of the Association of Edison Illuminating Companies. These specifications are widely used for this type of material.

The specifications cover materials; workmanship; properties, such as recommended thickness of insulation for the various types of cables; dielectric strength of insulation; change of power factor with voltage; long- and short-time electric strength before and after installation; mechanical properties; maximum operating temperature; measurements and tests, including selection of samples, and methods of measurement for the various properties of the cable.

Copies of these specifications will soon be available from the American Standards Association.

Illuminating Engineering Standards Revised

A revision of the American Standards on Illuminating Engineering Nomenclature and Photometric Standards (Z7-1924), made under the proprietary sponsorship of the Iluminating Engineering Society by its Committee on Nomenclature and Standards, has been approved by the American

Standards Association with the designation Z7-1932.

With few exceptions, the principal changes in the standards are re-wording in the interest of clarity and directness of statement, and not changes of substance.

The symbols and definitions approved in these standards have been widely adopted in other standards being prepared under the procedure of the American Standards Association. The committee of the Illuminating Engineering Society which prepared the standards has served as a subcommittee of the Sectional Committee on Definitions of Electrical Terms (C42), which is under the sponsorship of the Institute of Electrical Engineers. Group 55 "Illumination" of the report on the proposed American Standard Definitions of Electrical Terms (C42), prepared by this committee, also contains the definitions in the standards on Illuminating Engineering Nomenclature and Photometric Standards. The Definitions of Electrical Terms are now being circulated for comment and suggestion.

The symbols and abbreviations included in the Standards have also been accepted by the Sectional Committee on Scientific and Engineering Symbols and Abbreviations (Z10). The symbols have been approved separately as the American Standard Symbols for Photometry and Illumination (Z10d-1930), and the abbreviations are included in the draft of the standard on Abbreviations for Scientific and Engineering Terms (Z10i) circulated under date of June, 1932, which it is expected will be approved as American Tentative Standard.

Revision of Standard for Annular Ball Bearings

A revision of the American Tentative Standard for Annular Ball Bearings, Single Row Type (B3a-1930) was approved by the American Standards Association in January, 1933, as American Standard, with the designation B3.1-1933.

This revision consists of a change from 0.4 and 1.0 mm to 0.6 and 1.5 mm, respectively, in the dimensions r and H of the light-type bearing Number 39 (r designates the maximum radius of the fillet of a shaft or housing, and H, the minimum height of the shoulder on a shaft). The revision also includes the addition of the Separable (Open) Type Ball Bearings, and of the Angular Contact Type Ball Bearings in the light, medium, and heavy series.

The American Society of Mechanical Engineers and the Society of Automotive Engineers are sponsors for the project.

Revision of Safety Code for Mechanical Refrigeration

A revision of the Safety Code for Mechanical Refrigeration was approved by the American Standards Association on January 5, 1933.

The revision, made in order to bring the refrigerant methyl formate within the provisions of the code, is a very simple one. Methyl formate is added to the list of refrigerants contained in the definition of "flammable refrigerants" and the minimum test pressures on the high and low side are given for methyl formate in Table II, along with the test pressures for other refrigerants.

Copies of the revised code are available from the American Standards Association. The price of the standard will be 30 cents (20 per cent discount to Members of the American Standards Association).

Standards of School Lighting

The new Standards of School Lighting (A23-1932), recently approved by the American Standards Association, have been published. The standards were prepared under the joint sponsorship of the Illuminating Engineering Society and the American Institute of Architects. An article on the standards by Professor Henry B. Dates, secretary of the sectional committee in charge of the project, was published on page 25 of the January issue.

The price of the pamphlet is 20 cents per copy (20 per cent discount to Members of the American Standards Association). Copies may also be purchased from the Illuminating Engineering Society and from the American Institute of Architects.

Shaft Couplings for Hydro-Electric Units

A new American Standard entitled Shaft Couplings, Integrally Forged Flange Type for Hydro-Electric Units (B49-1932) was approved by the American Standards Association in December, 1932. It gives tables relating to the coupling dimensions, and to the drilling layout and bolt dimensions, respectively. The standard was developed by the A.S.M.E. committee on Standardization of Shaft Couplings, of which D. J. McCormack, sales manager, S. Morgan Smith Company, York, Pennsylvania, is chairman, and was approved by ASA as an existing standard. The American Society of Mechanical Engineers was appointed sole sponsor and agreed to have future revisions of the standard dealt with by sectional committee procedure.

ASA Approves Revised Standard on Steel Spiral Rods

The revised American Standard on Steel Spiral Rods for Concrete Reinforcement (A38-1933) (Simplified Practice Recommendation R53-32) has been approved by the American Standards Association. This is a revision of the former American Standard A38-1927, the revision consisting largely of a rearrangement of the tabular form in which certain data are presented, and the removal to tables in an appendix of other data now given for informational purposes. The revision has been accepted by industry under the procedure of the Division of Simplified Practice of the National Bureau of Standards as a revision to Simplified Practice Recommendation R53-26. The National Bureau of Standards and the Concrete Reinforcing Steel Institute are joint sponsors for the project.

Ainsworth Appointed Member of Child Welfare Committee

Cyril Ainsworth, assistant secretary of the American Standards Association, has been appointed to the membership of a permanent committee on the regulation of the employment of minors in hazardous occupations. The committee, which was set up by the Children's Bureau of the United States Department of Labor, is intended to supplement and continue the study begun by the White House Conference Committee in setting up standards for the guidance of those concerned with the reduction of hazardous employment for young workers.

Safety Conference Will Discuss Need for Specifications

The program for the Fourth Annual Greater New York Safety Conference contains two topics of direct relation to the ASA safety code program. William H. Cameron, managing director of the National Safety Council, will discuss the value of safety devices in the prevention of injury, with special emphasis on the need for specifications to control quality. W. R. Smith, assistant chief engineer, United Engineers and Constructors, who is chairman of the sectional committee developing the safety code for construction work, will discuss "Safety Standards as a Factor in Accident Prevention," pointing out how standards can be developed into constructive accident-prevention tools. Several other topics will bear directly on phases of the American Standard safety code program.

In all, 58 topics will be discussed in the 16 sessions of the Conference, which will be held at the Pennsylvania Hotel, New York, on March 1 and 2, 1933. An extensive exhibit of safety devices will also be held in connection with the Conference. Advance registration blanks may be obtained from the American Standards Association. No registration fee will be charged.

American Standard Used in Fire Hose Purchases

A cooperative plan for the purchase of fire hose has been developed by the League of Wisconsin Municipalities for the benefit of the members of the League. The plan requires that fire hose be purchased under the specifications approved by the American Standards Association. The League is also urging all municipalities to use the standard fire hose couplings. The development of the plan followed careful study of the cooperative purchase methods of the Michigan Municipal League.

Standards Valuable to Architects

The establishment of national standards for certain materials and methods of construction is of direct benefit to the practicing architect, eliminating the necessity for much independent research and investigation, the cost of which would be prohibitive, and making available standard specifications and test methods to which the architect can safely refer without the necessity for covering in detail those items for which definite standards have been adopted and accepted by the industry.—*From an article by F. Leo Smith, technical secretary of the American Institute of Architects, appearing in the "Octagon".*

Index to A.S.T.M. Standards

The annual index to the standards and tentative standards of the American Society for Testing Materials has just come from the press and is available for free distribution to all who are interested in the standards within the field of the Society's activities. This pamphlet contains complete listing of the 667 A.S.T.M. standards and tentative standards, indexed under appropriate key words by materials or subjects, and is a valuable reference for readily locating any specification or method of test.